

CLAIMS

- [C001] 1. A method of forming a toroidal winding assembly comprising:
- forming a longitudinal assembly having a first assembly end and a second assembly end;
- bending said longitudinal assembly to form a generally toroidal assembly; and
- bonding said first assembly end to said second assembly end to form said toroidal winding assembly.
- [C002] 2. The method of Claim 1 wherein forming said longitudinal assembly comprises:
- providing a winding core; and
- winding at least one electrical conductor around said winding core to form said longitudinal assembly;
- said winding core comprising a substantially non-ferromagnetic core material.
- [C003] 3. The method of Claim 2 wherein said core material comprises a core polymer.
- [C004] 4. The method of Claim 3 further comprising curing said core polymer.
- [C005] 5. The method of Claim 4 wherein curing said core polymer comprises exposing said core polymer to a curing stimulus selected from the group consisting of ultraviolet radiation, chemical curing agents, and heat.
- [C006] 6. The method of Claim 2 wherein providing said winding core comprises:

mixing a mixture of about 100 parts of diglycidyl ether of bisphenol A and about 10 parts of diethylene triamine at a mixing temperature in a range from about 50 to about 70 degrees Celsius; and

curing said mixture at a curing temperature of about 25 degrees Celsius.

[C007] 7. The method of Claim 3 wherein providing said winding core comprises:

providing a rubber winding core; and

curing said rubber winding core with heat.

[C008] 8. The method of Claim 2 wherein forming said longitudinal assembly further comprises winding at least one spacing wire around said winding core abutting said at least one electrical conductor.

[C009] 9. The method of Claim 8 further comprising unwinding said at least one spacing wire after bending said longitudinal assembly.

[C010] 10. The method of Claim 2 wherein forming said longitudinal assembly further comprises:

inserting a stiffening rod into a longitudinal hole of said winding core prior to winding said at least one electrical conductor around said winding core; and

extracting said stiffening rod after winding said at least one electrical conductor around said winding core.

[C011] 11. The method of Claim 1 further comprising coating said longitudinal assembly with a motion constraining material.

[C012] 12. The method of Claim 11 wherein said motion constraining material comprises a coating polymer.

[C013] 13. The method of Claim 12 further comprising curing said coating polymer.

[C014] 14. The method of Claim 13 wherein curing said coating polymer comprises exposing said coating polymer to a curing stimulus selected from the group consisting of ultraviolet radiation, chemical curing agents, and heat.

[C015] 15. The method of Claim 11 wherein coating said longitudinal assembly with a motion constraining material comprises:

mixing a mixture of gelatin and ammonium dichromate;

coating said longitudinal assembly with said mixture; and

baking said coated longitudinal assembly at a baking temperature in a range from about 50 to about 60 degrees Celsius.

[C016] 16. The method of Claim 11 wherein coating said longitudinal assembly with a motion constraining material comprises:

solvent casting polychloroprene so as to coat said longitudinal assembly;

and

baking said coated longitudinal assembly at a baking temperature in a range from about 25 to about 35 degrees Celsius.

[C017] 17. The method of Claim 11 wherein coating said longitudinal assembly with a motion constraining material comprises:

solvent casting styrene-butadiene-styrene co-polymer so as to coat said longitudinal assembly; and

baking said coated longitudinal assembly at a baking temperature in a range from about 50 to about 75 degrees Celsius.

[C018] 18. The method of Claim 2 wherein:

forming said longitudinal assembly further comprises applying to said winding core a winding support layer having a plurality of winding grooves; and

winding at least one electrical conductor around said winding core further comprises winding said at least one conductor in said winding grooves.

[C019] 19. The method of Claim 2 wherein forming said longitudinal assembly further comprises inserting said winding core into an outer shell after winding said at least one conductor around said winding core.

[C020] 20. The method of Claim 19 wherein:

said outer shell comprises an outer shell material adapted to contract upon exposure to a contraction stimulus; and

forming said longitudinal assembly further comprises exposing said outer shell to said contraction stimulus after inserting said winding core into said outer shell.

[C021] 21. The method of Claim 19 wherein forming said longitudinal assembly further comprises filling an annular gap between said winding core and said outer shell with a filler material.

[C022] 22. The method of Claim 21 wherein said filler material comprises a filler polymer.

[C023] 23. The method of Claim 22 wherein said filler polymer comprises polychloroprene.

[C024] 24. The method of Claim 22 further comprising curing said filler polymer.

[C025] 25. The method of Claim 24 wherein curing said filler polymer comprises exposing said filler polymer to a curing stimulus selected from the group consisting of ultraviolet radiation, chemical curing agents, and heat.

[C026] 26. The method of Claim 21 further comprising removing said outer shell after bending said longitudinal assembly.

[C027] 27. The method of Claim 1 wherein forming a longitudinal assembly comprises:

providing a dielectric sheet substrate;

producing a first pattern of electrically conducting strips on a first face of said dielectric sheet substrate, each of said electrically conducting strips having a first strip end and a second strip end coinciding with a first sheet edge and a second sheet edge, respectively;

attaching said first sheet edge to said second sheet edge such that said first strip end of each of said electrically conducting strips forms an electrically conductive junction with said second strip end of an adjacent one of said electrically conducting strips;

joining each of said electrically conductive junctions to form said longitudinal assembly.

[C028] 28. The method of Claim 27 wherein forming a longitudinal assembly further comprises producing a second pattern of electrically conducting strips on a second face of said dielectric sheet substrate, said electrically conducting strips forming an inner conducting coil inside an outer conducting coil.

[C029] 29. A method of forming a toroidal winding assembly comprising:

providing a winding core comprising a substantially non-ferromagnetic core polymer;

winding at least one electrical conductor around said winding core;

winding at least one spacing wire around said winding core abutting said at least one electrical conductor to form a longitudinal assembly having a first assembly end and a second assembly end;

bending said longitudinal assembly to form a generally toroidal assembly;

unwinding said at least one spacing wire after bending said longitudinal assembly; and

bonding said first assembly end to said second assembly end to form said toroidal winding assembly.

[C030] 30. A toroidal winding assembly comprising:

a winding core; and

at least one electrical conductor wound around said winding core to form a longitudinal assembly;

said winding core comprising a substantially non-ferromagnetic core material; and

said longitudinal assembly being bent to form a generally toroidal assembly and having a first assembly end bonded to a second assembly end.

[C031] 31. The toroidal winding assembly of Claim 30 wherein said core material comprises a core polymer.

[C032] 32. The toroidal winding assembly of Claim 31 wherein said core polymer comprises 100 parts of diglycidyl ether of bisphenol A and 10 parts of diethylene triamine.

[C033] 33. The toroidal winding assembly of Claim 31 wherein said core polymer comprises a rubber.

[C034] 34. The toroidal winding assembly of Claim 30 further comprising a motion constraining material coating said longitudinal assembly.

[C035] 35. The toroidal winding assembly of Claim 34 wherein said motion constraining material comprises a coating polymer.

[C036] 36. The toroidal winding assembly of Claim 35 wherein said coating polymer comprises gelatin and ammonium dichromate.

[C037] 37. The toroidal winding assembly of Claim 35 wherein said coating polymer comprises polychloroprene.

[C038] 38. The toroidal winding assembly of Claim 35 wherein said coating polymer comprises styrene-butadiene-styrene co-polymer.

[C039] 39. The toroidal winding assembly of Claim 30 wherein:

said longitudinal assembly further comprises a winding support layer having a plurality of winding grooves, said winding support layer being disposed on said winding core; and

said at least one conductor is wound in said winding grooves.

[C040] 40. The toroidal winding assembly of Claim 30 wherein said longitudinal assembly further comprises an outer shell surrounding said winding core and said at least one conductor.

[C041] 41. The toroidal winding assembly of Claim 40 wherein said outer shell comprises an outer shell material adapted to contract upon exposure to a contraction stimulus.

[C042] 42. The toroidal winding assembly of Claim 40 wherein said longitudinal assembly further comprises a filler material filling an annular gap between said winding core and said outer shell.

[C043] 43. The toroidal winding assembly of Claim 40 wherein said filler material comprises a filler polymer.

[C044] 44. The toroidal winding assembly of Claim 43 wherein said filler polymer comprises solvent cast polychloroprene.

[C045] 45. A toroidal winding assembly comprising:

a dielectric sheet substrate; and

a first pattern of electrically conducting strips disposed on a first face of said dielectric sheet substrate, each of said electrically conducting strips having a first strip end and a second strip end coinciding with a first sheet edge and a second sheet edge, respectively;

said first sheet edge being attached to said second sheet edge such that said first strip end of each of said electrically conducting strips forms an electrically conductive junction with, and is joined to, said second strip end of an adjacent one of said electrically conducting strips.

[C046] 46. The toroidal winding assembly of Claim 45 further comprising a second pattern of electrically conducting strips disposed on a second face of said dielectric sheet substrate, said electrically conducting strips forming an inner conducting coil inside an outer conducting coil.